Koichiro MIURA* & Sachiko OKANO**: *Lateriramulosa quadriradiata*, a new aquatic Hyphomycete

三浦宏一郎*・岡野祥子**: 水生不完全菌類の一新種 *Lateriramulosa quadriradiata*

In the majority of aquatic Hyphomycetes the conidium is of a tetra-radiate form consisting of four long arms. The tetra-radiate conidium, however, is formed in very different ways and the resultant structural make-up of the tetra-radiate conidium is very diverse in aquatic Hyphomycetes. The mode of the conidium ontogeny (the method of conidium formation) and the developmental pattern of the four-armed conidium (the pathway that leads to the tetra-radiate configulation) are considered to be fundamental features characterizing the genera of aquatic Hyphomycetes.

The fungus herein reported was found on submerged decaying leaves collected from a mountain stream near Nippara, Tokyo (November 18, 1976) and it produced tetra-radiate conidia. In structural make-up of the conidium, it showed no resembrance to any species that regularly occurred as submerged aquatic fungi, but it showed a close resemblance to *Lateriramulosa uniinflata*, a staurosporous fungus originally described from the terrestrial habitat. Therefore, morphological features, especially the mode of the conidium ontogeny and the developmental pattern of the conidium, of the fungus were critically studied.

Morphology The fungus in question was easily isolated in pure culture. It grows very slowly on LCA (Miura & Kudo, 1970). The mycelium is white in color and consists of hyaline, branched and septate hyphae on which irregular masses or chains of gemma-like cells are profusely formed. The colony on agar does not form conidia, but when strips of this colony are submerged in sterile water, abundant conidiophores and conidia are produced within two to three days. The conidiophores develop in water and they are hyaline, macronematous, mostly simple and septate. The conidia are formed

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and liberated below the water surface. They are undoubtedly aquatic conidia and agree well with the conidia produced on submerged leaves in nature.

The development of the conidium was observed under the microscope equipped with a water-immersion lens. Supplemental informations were obtained from observation on fixed and stained conidia at different stages of development. The development of the conidium is as follows. (1) The terminal end of a conidiophore becomes inflated (Fig. 1, F-1). The conidium starts to form as a swollen end of a conidiophore. (2) The swollen part is cut off by a septum to form a clavate to obovoid cell (Fig. 1, F-2). This cell is the conidial primordium and it becomes the central cell of the mature conidium (Fig. 1, G-O). (3) At about the middle of one side of the conidial primordium, there arises a spherical bud often oriented somewhat downwards (Fig. 1, F-3). This is the initial of the first branch of the conidium (Fig. 1, G-I). (4) The spherical bud begins to elongate at the tip in a slightly downward direction. At this stage the bud is triangular or conical. Meanwhile, another protuberance, the initial of the second branch (Fig. 1, G-II), is formed on the opposite side of the central cell. The second initial is level with the first initial or, more often, it is slightly higher than the first one (Fig. 1, F-4). (5) The initial of the second branch elongates apically and becomes rod-shaped. At about this stage a new growing point appears at the base of this initial (Fig. 1, F-5). Thus the initial with two growing points begins to grow in two different directions to form an open V-shaped or open U-shaped branch. (6) While the first branch and the second branch

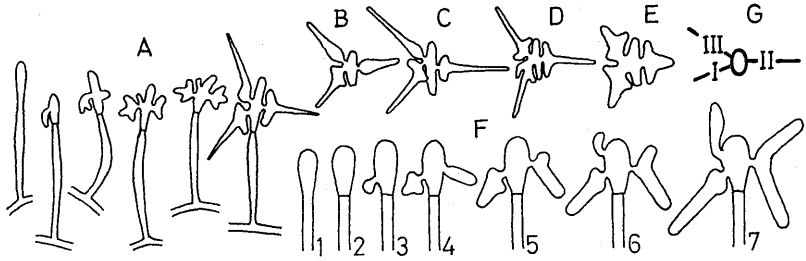

Fig. 1. A. *Lateriramulosa uniinflata;* developmental pattern of the conidium (redrawn from Marvanová, 1973). B. *L. ainflata.* C. *L. uniinflata.* D. *L. biinflata.* E. *L. minitriangularis* (B-E. redrawn form Matsushima, 1975). F-G. *L. quadriradiata;* F. Developmental pattern of the conidium; G. Structural make-up of the conidium.

are still in their earlier stages ef growth, the third branch (Fig. 1, G-III) starts its development. The initial of the third branch buds out a little behind the apex of the central cell and on the same side with the first branch (Fig. 1, F-6). (7) The initial of the third branch elongates upwardly by its apical growth so that it is more or less parallel with the longitudinal axis of the central cell (Fig. 1, F-7). These three branches continue their growth to form long arms of the conidium. When the conidium is mature, it is liberated from the conidiophore by disjunction at the basal septum.

The mature conidium consists of a central cell (Fig. 1, G-O) and three lateral branches (G-I-III). In other words, they consists of a central cell and four divergent arms, the second branch contributing two of the arms. The central cell is clavate, obovoid or ellipsoid, and non-septate. Three lateral branches, a pair of opposite ones (G-I & III) and a sub-apical one (G-II), are formed in succession. They are filamentous and linked to the central cell by a narrow isthmus. The first branch (G-I) is simple, mostly 1-septate and a little swollen just above its basal constriction. The second branch (G-II) is open U- or V-shaped and mostly 2-septate. The third branch (G-III) is simple and mostly 1-septate, but an additional septum is often formed at its basal isthmus. The conidium of this fungus is no doubt an aleuriospore (a terminal thalloconidium).

After the first conidium is liberated, or before the development of the first conidium is completed, a new conidium begins to form. A short distance below the first conidium, the conidiophore gives rise to a short branch from which the primordium of the second conidium is formed. Subsequent development of the second primordium is the same as that of the first primordium. Following the same manner, a number of conidia are produced. As a result, the upper part of the conidiophore becomes branched with a number of stump-like branchlets from which conidia have been liberated. Sexual reproduction of this fungus took place neither on agar nor on leaves.

Taxonomic consideration *Lateriramulosa* was proposed by Matsushima (1971) on the basis of *L. uniinflata* isolated from rotten leaves of a broad-leaved tree in Rabaul, the Solomon Isls. Three additional species, namely, *L. ainflata*, *L. biinflata* and *L. minitriangularis* (as *L. minitriangularia*), were also described by the same author from similar substrata from Japan (Matsushima, 1975). Conidia of these species consist of a non-septate central

cell and three lateral branches, of which two are on one side of the central cell and the rest is on the opposite side (Fig. 1, B-E). It is clear that the present fungus is remarkably similar to *Lateriramulosa* species in the structural make-up of the conidium. On the other hand, the development of the conidium was studied in *L. uniinflata* by Marvanová (1973). In *L. uniinflata* the conidium is apparently an aleuriospore (a terminal thalloconidium) and the branches of the conidium develop in strict succession as they also do in the present fungus (Fig. 1, A). Undoubtedly not only the mode of the conidium ontogeny but also the developmental pattern of the conidium is essentially the same in both fungi.

However, the present fungus differs from *L. uniinflata*, the type species of the genus, in a number of features that are often used as criteria for characterizing genera of the Hyphomycetes. Firstly, the conidiophore of the present fungus is macronematous, while that of *L. uniinflata* is, by definition, micronematous. Matsushima (1971) stated in his original description, 'Conidiophora absentia....Conidia....ex dentibus hypharum vegetativarum oriunda, qui usque ad 6 μ longi....' But, according to Marvanová (1973), 'conidiophores are....up to 30 μ long....' In *L. uniinflata* the conidiophore seems more or less variable in size. And, it seems unlikely that the conidiophore of *L. uniiflata* is truly micronematous.

Secondly, the present fungus is dissimilar to *L. uniinflata* in the configulation of the conidium. The conidium of the former is 'tetrapod'-shaped while that of the latter is flat and looks like a coenobium of the green alga *Pediastrum*. But it may be noted here that the present fungus is no doubt a submerged aquatic fungus with 'aquatic spores' (conidia that are normally produced, liberated and dispersed below the surface of water; Ingold, 1942). Concerning the aquatic tetra-radiate conidium in aquatic Hyphomycetes, Ingold (1966, 1975) suggested that the tetra-radiate configulation had a real biological advantage in the aquatic environment and that it had been evolved independently along a number of different lines. The conidial configulation of the present fungus also seems to be brought about through adaptation to the submerged aquatic mode of life. Therefore, the dissimilarity in configulation of the conidium may well be considered taxonomically less important than the similarity in structural make-up of the conidium.

Thirdly, in the present fungus branches of the conidium are septate,

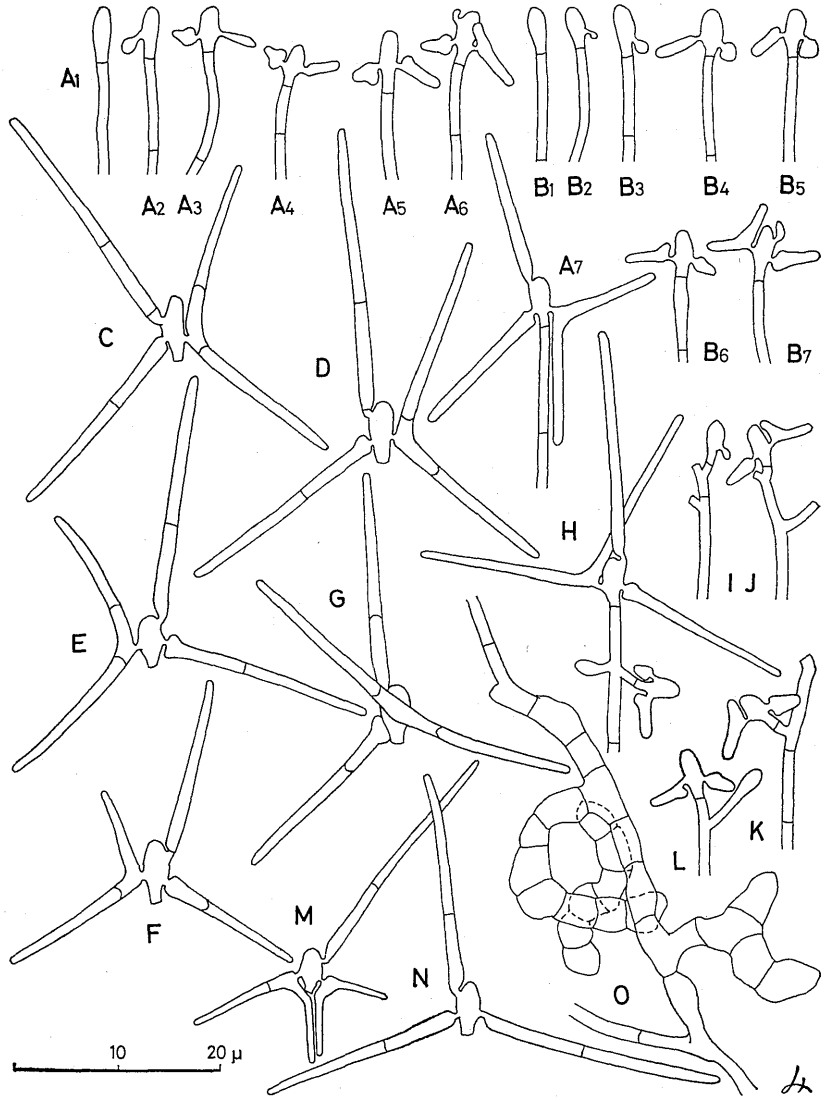

Fig. 2. *Lateriramulosa quadriradiata.* A_1-A_7, B_1-B_7. Conidia at various stages of development. C-G. Mature conidia. H-L. Proliferation of conidiophores. M-N. Atypical conidia. O. Chain of gemma-like cells.

while in *L. uniinflata* they are continuous. However, there are some genera in which septation of the conidium has been overlooked in favor of more fundamental taxonomic criteria, though great stress is placed in the Saccardo system on the presence or absence of septation of the conidium. It seems more logical to include the present fungus in the genus *Lateriramulosa*.

In the last place, it should be pointed out that the conidium of the present fungus agrees fairly well with the conidium formerly reported by the senior author from stream scum in Rebun Isl., Hokkaido, Japan (Miura, 1974, Type 73). Though the conidium from Rebun Isls. was non-septate, it probably belongs to the same species with the present fungus.

Lateriramulosa quadriradiata Miura & Okano, sp. nov.

Fungus aquaticus submersus. Mycelium, hyalinum, tarde crescens. Hyphae vegetativae hyalinae, septatae, ramosae, 0.9-2.0 μ latae. Conidiophora hyalina, septata, plerumque simplicia, 30-115 μ longa, apice ca. 1.0 μ lata. Conidia (aleuriosporae) acrogena, solitaria, hyalina, septata, quadriradiata, ex cellula centrali et ramulis tribus lateralibus constantia; cellula centralis continua, clavata vel obovoidea vel ellipsoidea, 4.2-6.7×1.8-2.5 μ, in media parte ramulos duos oppositos (ramulum I et ramulum II) et in loco infra-apicali ramulum unum (ramulum III)—hinc ramulos duos (I et III) illinc ramulum unum (II)—gerens; ramuli laterales deinceps evoluti, filiformes, apicem versus ad 0.7-1.0 μ attenuati, ad cellulam centralem per isthmo affixi; ramulus primus (ramulus I) plerumque 1-septatus, prope basim plus minusve tumens, 13-24×1.5-2.5(-3.0) μ; ramulus secundus (ramulus II) plerumque 2-septatus, curvatus, latere convexo prope medium ad cellulam centralem affixus, 23-40×1.3-2.0 μ; ramulus tertius (ramulus III) plerumque 1-septatus, 16-28(-34)×1.2-1.6 μ.

Hab. in foliis putrescentibus dicotyledonearum plantarum in flumine submersis, prope Nippara, Tokyo, November 18, 1976.

Holotypus in TNS.

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東京都日原の渓流中の腐葉から得た水生不完全菌類の一新種 *Lateriramulosa quadriradiata* を報告する。*Lateriramulosa* 属の各種はいずれも陸上の腐葉から記録され，分生子は1箇の主軸細胞とこれより順次形成された3側枝とからなり，全体は平板状をなす。本種は，第2側枝が基部で分枝して全体はテトラポッド形をなすという顕著な特徴をもつものの，分生子の基本構造・分生子型・分生子発達過程の点で *Lateriramulosa* 属のタイプ種と一致する。本種は水生不完全菌類の四射形分生子の発達パターンに新しい型を加えるものと思う。先に未記載菌の分生子として礼文島から報告されたもの（三浦，1974, Type 73）は，恐らくは本種のものであろう。

□Heywood, V. H. (ed.) **Flowering plants of the world.** 335 pp. 1978. Oxford University Press, Oxford. ¥4,290. Heywood が主となり，英国系の分類学者を主とした40数名，八ケ国の学者が協力して作った，全顕花植物の分類系の図譜兼一覧図ともいえるものである。全体のシステムは Cronquist (1968) の流れをくむ Stebbins (1974) のシステムを，さし当りの標準としているが，双子葉類を6個の群に，単子葉類を4個の群に大別している。はじめに用語集を主にした総説をかかげ，ついでモクレ科からはじめて各科毎に述べられている。大部分の科毎に，科の大綱，分布，標徴的な形質，分類，利用面を述べ，半ページの2-3種の図が添えられている。これらはほとんど部分的な彩色図である。さらに小さい分布図に添えて属種の数，分布，及び利用の荒すじをかこんで出してあって，それが著るしく目立っている。図は Goaman, Dunkley, King に三女性が描いたもので中々風韻がある。小数の科はページ大の図1〜2とするなどしているが，大部分は半分の大きさなので，どうしても精緻を欠く憾みがあるのは惜しい。何といっても地図に分布地を赤く示したのは，恐らくはじめてで大変注目をひくものであり，色々と役立つと思われる。たとえば，コーカサスから中央アジアを経てオホーツク海まで，ラン科が分布していない図になっているなどまことに意外であるし，ドクウツギについては前川の議論に全く触れていないなども気になる。いずれにせよ新らしい論議をひき起しうる出版物として大いに注目に値するであろう。（前川文夫）